Proposed Agreement between California Energy Commission and KEMA, Inc.

Title: Evaluation and Optimization of Concentrated Solar Power Coupled with Thermal Energy Storage
Amount: $447,642.00
Term: 42 months
Contact: Prab Sethi
Committee Meeting: 3/16/2011

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Natural Gas	Renewables	Develop Low-Cost and Thermally Efficient Energy Storage System for CSP	$1,036,147	$447,642	$0	0%

Recommendation

Approve this agreement with KEMA, Inc. for $447,642.00. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

Issue

According to Governor Jerry Brown's new energy plan, by 2020, California should produce 20,000 new megawatts (MW) of renewable electricity. Furthermore the Governor calls for the Legislature to codify a requirement that 33% of the state's electricity be derived from renewable sources. This step builds upon Governor Arnold Schwarzenegger's Executive Order S-14-08 that directed state government agencies to take actions to help achieve California's Renewable Portfolio Standard (RPS) goal, which requires electricity retail sellers to serve 33 percent of their load with renewable energy by 2020.

Governor Brown's energy plan builds even further upon these goals, adding the additional goal of 12,000 megawatts of Localized Electricity Generation; 8,000 Megawatts of Large Scale Renewables; and increasing combined heat and power production by 6,500 megawatts. Localized energy is onsite or small energy systems located close to where energy is consumed that can be constructed quickly (without new transmission lines) and typically with relatively low environmental impact. Combined heat and power projects (also known as cogeneration) use the excess heat or electricity generated by power plants or industrial facilities and are much more efficient than traditional power plants and many industrial plants.

Solar development and particularly utility scale solar development is a crucial part of achieving these various goals in Governor Brown's energy plan. The California Public Utilities Commission (CPUC) suggests that the technology mix, for the baseline scenario to reach 33 percent by 2020, will primarily

rely on wind, solar thermal, geothermal, solar photovoltaics (PV) (at generation of 44 percent, 24 percent, 15 percent, 9 percent respectively) and the rest from low levels of biomass, biogas and small hydro (generation of 4 percent, 3 percent and <1 percent respectively).

Background

On November 2, 2010 the California Energy Commission (Energy Commission) PIER Renewable Program released a Request for Proposals (RFP) for research needs of utility-scale renewable energy. The RFP announced that up to $7.3 million were available from the PIER Program to fund initiatives that will help meet Research, Development and Demonstration (RD&D) needs related to more rapid and environmentally responsible deployment of Utility-Scale Renewable Energy (USRE) to the California electricity grid. The goal of the RFP was to support increased market penetration of multiple renewable energy technologies; reduction of impacts on land use, water consumption and ecosystem resources; and mitigation of technical and economic barriers to the increased injection of non-baseload renewable energy sources into the transmission system.

Outreach to expand awareness of the RFP included pre-proposal workshops on November 9, 2010 held in the Energy Commission's Hearing Room A, in Sacramento, California and on November 16, 2010 held in the George T. Booker Conference Room in the University of California San Diego. The workshop covered in detail the application process, and provided a forum for questions and answers. The workshops, RFP, and questions and answers were advertised and published on the Energy Commission website.

On the proposal due date of December 21, 2010, the Energy Commission received 28 proposals. In accordance with the 2010 RFP Package, each proposal was screened for completeness, and reviewed by Energy Commission staff. Nine proposals were rejected from the administrative screening process. The TAC reviewed, evaluated, and scored the proposals using the criteria prescribed in the Application Package.

Proposed Work

The overarching goal of this project is to define the benefits, costs, and impacts of increasing penetration of coupled concentrated solar power (CSP)-thermal energy storage (TES) to the California electricity grid, along with the system configurations and control strategies needed to optimize economic and engineering performance. This goal will be achieved by linking transient (dynamic) thermodynamic models of several key CSP-TES configurations, grid control, and electricity markets to achieve results that encompass generation, transmission, and sale of stored solar thermal energy. The following work will be performed under this project:

- detailed thermodynamic modeling of nine specific CSP-TES configurations, optimization and integration of those models for dispatch
- simulation of market outcomes in market simulation and economics models
- bring the methodology and outcomes of our dynamic modeling to the market through dedicated technology transfer activities.

Justification and Goals

This project "[will develop, and help bring to market] advanced electricity technologies that reduce or eliminate consumption of water or other finite resources, increase use of renewable energy resources, or improve transmission or distribution of electricity generated from renewable energy resources" (Public Resources Code 25620.1.(b)(4)), (Chapter 512, Statues of 2006)).

This will be accomplished by:

- • Reduced ancillary services requirements and real time dispatch costs at a system level as a result of improved and managed CSP generation variability and ramping behavior, as well as reduced emissions from substituting for stand-by convention generation for these services;
- • Improved system reliability as measured by system dynamic performance (area control error, frequency) and system ability to withstand events such as wind ramping, cloudiness and unit trips;
- • Improved system reliability in terms of frequency response to disturbances that are improved as a result of CSP inertial and governor response. (As compared with the lack of same from PV and wind resources);
- • Enhanced understanding of the economics - cost benefit comparison - of thermal storage and CSP reconfiguration to avoid gas co-firing and to allow the provision of ancillary services.
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